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TO: Brooke Barnes / Stantec Consulting
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RE: HANCOCK WIND PROJECT
VISUAL IMPACTS OF ADDITIONAL DESIGN OPTION
COMPARATIVE ANALYSIS: Approved Siemens SWT 3.0 113 v. Vestas V117 Turbines

Hancock Wind, LLC is submitting an amendment to the Hancock Wind Project (Project) to allow the option of using a third turbine type, the Vestas V117. The existing Project has been approved for use of either 18 Siemens SWT 3.0 – 113 machines, which have a 99.5m hub height, 113m rotor diameter, and maximum tip-of-blade height of 156m (512 feet), or 18 Vestas V112 machines, which have a 94m hub height, 112m rotor diameter, and a maximum tip-of-blade height of 150m (492 feet). The Vestas V117 option is a 3.3 MW machine with a 116.5m hub height, 117m rotor diameter, and total height of 175m (574 feet).

Use of the V117 option eliminates the turbine closest to Spectacle Pond on Spectacle Pond Ridge. The location of the remaining 17 turbines will not change, i.e., they will be in the same approved locations on Spectacle Pond Ridge and Schoppe Ridge in Township 22 MD.

For purposes of this analysis we have reviewed the potential change in visibility between the 17 Vestas V117 turbines (574 feet) option and the 18 Siemens SWT 3.0-113 turbines (the taller of the two approved options). As we did in the original Visual Impact Assessment (VIA), we examined the potential visual impact from the proposed Vestas V117 turbines on four Scenic Resources of State of National Significance (SRSNS): i.e., Narraguagus Lake, Upper Lead Mountain Pond, Lower Lead Mountain Pond, and the summit of Tunk Mountain. We also determined that the increase in height would not result in visibility on other SRSNS.

The initial VIA reviewed up to three 105m temporary meteorological (met) towers. The met towers may be freestanding or of a guyed lattice construction with an 18±" triangular cross section. In May 2013, we amended the VIA to include two additional temporary met towers, each 60m in height. All met towers over 200 feet would be lit per FAA requirements.

The additional design option includes an increase in height for the three original met towers to 116.5m to match the hub height of the turbines. The 60m met towers would remain the same height. None of the met towers would be visible from Narraguagus Lake, Upper Lead Mountain Pond, or Lower Lead Mountain Pond. The towers would be beyond 8 miles from Tunk Mountain and not discernible. Except for the elimination of infrastructure associated with the eliminated turbine (i.e., access road, underground electrical collection line, and crane pad) and the increased height for three met towers, there are no additional changes to the associated facilities for the Project.

This analysis examines Criterion F: Scope and scale of project views that the Maine Wind Energy Act (WEA) uses to determine if a Project will have an unreasonable adverse effect on the scenic character and existing uses relate to scenic character of a SRSNS (§3452.3 Determination of effect on scenic character and related existing uses). In performing this analysis we are assuming that the other criteria in the WEA have not changed since the VIA was written, and that the only issue to be addressed is the increased size of the proposed turbines as described above. This criterion looks at the number of turbines visible, their position in the landscape, the angle of view that they are seen over, and the distance from the observer. Only turbines within eight miles of the SRSNS are considered.

COMPARATIVE VIEWSHED ANALYSIS

The viewshed maps developed for the original VIA were revised with the new turbine data to determine the change in visibility within the study area in general and to the SRSNS in particular (See Appendix A). The revised viewshed maps reflect the increase in overall turbine height (62 feet), the increase in tower height (55.7 feet), the increase in rotor diameter (13.1 feet), the removal of one turbine on Spectacle Pond Ridge, and the corresponding minimal reduction in the 3 and 8-mile study area.

The turbine viewshed will increase slightly on the three water bodies due to the greater turbine height. In all cases, the resultant change in visibility will be minor, due to the viewing distances involved and the position of the turbines relative to the treeline, as seen in the photosimulations (Appendix C). From Tunk Mountain, where the turbines would be 6.9+ miles away and would not appear to break the horizon, the change in height will not be appreciable.

The taller tower heights of the additional design option would elevate the nacelles and the FAA warning lights (if required). This may allow two lights to be seen just above the treeline on Upper Lead Mountain Pond and up to four lights just above the treeline on Lower Lead Mountain Ponds. Our initial VIA estimated a few lights might be visible from the northern ends of both Upper and Lower Lead Mountain Ponds, filtered through the evergreen trees on the low hills to the south. Visibility of the lights would depend upon the height and location of individual trees on the low ridges surrounding the ponds and whether the nacelles, as opposed to the blades, of the turbines would be visible.

WindPro and cross sectional analyses of the additional design option indicate potential visibility of nacelles (and therefore light if those nacelles were lit) visibility from the northern end of each pond. As the viewer moves southward on the ponds, the nacelles (and lights) would become less visible. Actual nighttime use of the pond is expected to be very low, based upon inherent hazards from submerged rocks and other obstacles. The number of lights seen on Narraguagus Lake would remain constant with the additional design option. There would be no lights visible from the populated cove at the northwest end of Narraguagus Lake.

Finally, the change in height for the proposed design option does not result in turbine or lighting visibility from the other SRSNS within 8 miles of the Project: i.e., Middle Lead Mountain Pond, Myrick Lake, Little Long Pond, Spring River Lake, Tilden Pond, Fox Pond and the Eastbrook Baptist Church and Town House in Eastbrook.

We have created a new page of enlargements to provide a more detailed understanding of potential visibility (See, page 9 of Appendix A). Enlarged portions of the original viewshed analyses are shown

on the left side of the page; the viewshed analyses for the additional design option are shown on the right side of the page. The enlargements are derived from Maps 4 and 4B, which take into consideration both topography and vegetation to determine where and how many hubs (nacelles) and blades would be visible. However, as noted in the original VIA and confirmed by the peer review conducted by Dr. James Palmer, these maps tend to overstate turbine visibility due to the assigned size of vegetation.

- **Lower Lead Mountain Pond.** The original viewshed analysis indicated that up to 11 nacelles would be visible over 38±% of the pond. However, as noted above, this percentage overstates the potential visibility since it does not take into account the size of the mature trees that are found along the shoreline. After completing the WindPro modeling and photosimulations, we determined that only the blades of up to ten turbines (and no nacelles) would be visible from the viewpoint used in Photosimulation 1.

  The viewshed analysis for the additional design option indicates that the proposed Vestas V117 turbines would be more visible and would increase the area of visibility on Lower Lead Mountain Pond to approximately 40%. WindPro modeling used to create the photosimulation shows that up to four nacelles may be visible, at or slightly above the treeline, and the blades of an additional five turbines may be visible. (The decrease in the number of visible turbines is due to the elimination of one turbine in this additional design option.)

- **Upper Lead Mountain Pond.** The original viewshed analysis indicated that 1± % of the pond at its far northern end may have views of up to 4 nacelles. However, after completing the WindPro modeling and photosimulations, we determined that only the blades of up to 3 turbines (and no nacelles) would be visible with the original turbines. (See Photosimulation 2.)

  With the additional design option, the viewshed map indicates that up to 4 nacelles would be seen over 9% of the pond. The WindPro modeling used to create the photosimulation shows that two nacelles would be visible, at or slightly above the treeline. Only the blades of the other two turbines would be visible.

- **Narraguagus Lake**. The original viewshed analysis indicated that up to 8 turbines (nacelle and blades) would be seen over 18±% of the lake. After completing the WindPro modeling for the photosimulations, we determined that 6 turbines would be seen from the lake within 8 miles, and that the nacelles would be visible in most instances.

  With the additional design option and taller turbines, the number of turbines and visible nacelles remains constant. However, the revised viewshed analysis indicates that they would be seen over approximately 24% of the lake.

- **Tunk Mountain.** The viewshed analyses for Tunk Mountain show that the additional design option would not result in a significant change in turbine visibility. Four of the 18 initially approved Siemens turbines would be visible within 8 miles. With one turbine eliminated with the additional design option, four of the 17 Vestas V117 turbines would be visible within 8 miles. The turbine being removed is located more than 8 miles from the summit of Tunk Mountain.

PHOTOSIMULATION ANALYSIS

All the photosimulations that were prepared for the original VIA have been revised with the new layout and turbine data as described above (see Appendix C). In most instances, the difference in visibility between the original photosimulation and the additional design option is minimal.

The following is a summary of the change in visibility between the original and the revised photosimulations:

- **Lower Lead Mountain Pond.** The original VIA found that views of the Project on Lower Lead Mountain Pond would be concentrated in the northwesterly corner of the pond, about one mile north of the boat launch. From here the blades of up to 10 of the original Siemens turbines would be visible at or just above the horizon line, at a distance of more than 6 miles.

  With the approved turbines, a few of the red warning lights may be visible from the northern end of the lake. Visibility of the lights was expected to be variable, depending on the height and location of individual trees on the low ridges surround the pond. Nighttime use of the pond is expected to be very low, based upon the inherent hazards from submerged rocks and other obstacles.

  With the additional design option and the removal of the turbine on Spectacle Pond Ridge, only 9 turbines would be visible. Of those 9, 4 nacelles may be visible at or just above the treeline, as seen in the photosimulation. The blades of up to an additional 5 turbines may be visible. The view of the turbines would not interfere with or be seen in conjunction with the easterly view toward Lead Mountain, the focal point on the pond. The Vestas V117 turbines would be seen over horizontal arc of 17º (2º less than the original) from the viewpoint used in the photosimulation. This would be approximately 5% of the 360-degree view that a person would see from this end of the pond.

  With the taller tower, up to four FAA warning lights may be visible, depending upon the lighting pattern and the height of intervening trees. The warning lights (if required) would likely be seen from a maximum of 40% of the pond, partially filtered by intervening evergreen trees.

- **Upper Lead Mountain Pond**. The original VIA found that views of the Project on Upper Lead Mountain Pond would be limited to the northeasterly end of the pond. From here the blades of up to 3 turbines would be seen at or just above the horizon line, at a distance of more than 6 miles. The turbines would be visible over a horizontal arc of 2º. This represents approximately 0.5% of a 360-degree view that a person would see while on this end of the pond.

  Because the Vestas V117 turbines proposed for the additional design option are taller, the blades of 4 turbines, and possibly the nacelles of two of those turbines, may be more visible at or just above the treeline. The view of four turbines would increase the horizontal arc of Project visibility from 2º to 4º. This represents 1.1% of a 360-degree view that a person would see while on the pond.

With the taller tower, two FAA warning lights may be visible. The warning lights (if required) would likely be seen from a maximum of 9% of the pond, partially filtered by intervening evergreen trees.

The view of the turbines will not interfere with or be seen in conjunction with the easterly view toward Lead Mountain, the focal point of the pond.

- **Narraguagus Lake**. The original VIA found that the Hancock Wind Project would have an incremental visual effect on Narraguagus Lake by adding 6± turbines within 5.7 to 8.0 miles to the 14-19 Bull Hill turbines that are currently seen at distances of 2.0 to 5.7 miles. Because the Vestas V117 turbines proposed for the additional design option are taller, the nacelles and blades of the 6± turbines within 8 miles will be slightly more visible, as illustrated in the photosimulation.

  We have included a new illustration (p. 18 of 28) in Appendix C that contains an enlargement of the Project turbines as seen from Narraguagus Lake. The first image (on the left) is an enlarged portion of the original photosimulation, showing the blades and nacelles of the approved Siemens turbines. Six of the turbines seen in the photosimulation would be within 8 miles.

  In the middle image, the blue circles represent the rotor path of the Siemens turbines (113m rotor diameter with a total height of 156m). The magenta circles represent the rotor path of the Vestas turbines being proposed (117m rotor diameter with a total height of 175m). The Vestas nacelle would be located in the center of the magenta circle. The difference between the approved turbines and the additional design option is 4m/13 feet in rotor diameter and 19m/62 feet in total height. The image on the right is an enlargement of the photosimulation of the additional design option.

- **Tunk Mountain.** The original VIA found that the Hancock Wind Project would have an incremental visual effect on the northerly view from the summit of Tunk Mountain. Four of the Hancock turbines would be visible within 8 miles and would be seen in conjunction with the 19 existing Bull Hill turbines.

  The additional design option reduces the number of turbines from 18 to 17; the one that is being dropped is 9.5 miles from Tunk Mountain. Comparing the photosimulations prepared for the original VIA with the ones prepared for the additional design option shows that the increase in turbine height and rotor diameter would not result in an appreciable difference in visibility. The horizontal arc of visibility for the four turbines within 8 miles will remain the same.

CUMULATIVE IMPACT

The revised cumulative visual analysis map shows only minor changes in the combined visibility of the Hancock Wind and Bull Hill Wind Projects on SRSNS. (See Combined Visibility Maps 5 and 5B.)

- **Lower Lead Mountain Pond.** As stated in the initial VIA, several of the existing Bull Hill turbines are slightly visible from a very limited part of the northern end of Lower Lead Mountain

Pond. These turbines are located more than 8 miles from Lower Lead Mountain Pond, so there would be no cumulative visual impact due to the Hancock turbines.

- **Upper Lead Mountain Pond.** The existing Bull Hill turbines are not visible from Upper Lead Mountain Pond, so there would be no cumulative impact resulting from the amended Hancock Project.

- **Narraguagus Lake.** The initial analysis indicated that the only locations where the Hancock Wind turbines would be visible were those areas where the Bull Hill turbines were already visible, i.e., in the north and northeast portions of the lake. The revised combined viewshed analysis shows very little change. The majority of the lake (over 91%) currently has views of the Bull Hill Project. Approximately 49% would have views of proposed additional design option for Hancock Wind as well as Bull Hill, which is an increase of 4% over the original cumulative analysis.

- **Tunk Mountain**. As stated in the initial analysis, the combination of the existing Bull Hill project and the Hancock Wind Project will result in a combined cumulative visual impact to the northerly view from the north face of Tunk Mountain. The existing Bull Hill project (located entirely within 8 miles of Tunk Mountain) is seen over a horizontal arc of 22º. From the northern summit, the four proposed Vestas V117 wind turbines within 8 miles will still be visible over an arc of 6º at distances ranging from 6.9 to 7.0 miles. The removal of one turbine on Spectacle Pond Ridge will not affect the combined visual impact since it was greater than 8 miles from the summit.

CONCLUSION

The overall visual impact on SRSNS for the additional design option is anticipated to be low to medium, the same as the impact initially concluded for the Hancock Wind Project using Siemens SWT 3.0 113 turbines. The proposed additional design option for the Hancock Wind Project should not have an unreasonable adverse impact on scenic values and existing uses of these scenic resources of state or national significance.